from 7° to 15° away from the centre; it is here from ten to twenty times as great as at the fovea, which is in all cases the lowest point of the curve. Different individuals furnish curves which differ very much in detail; Fräulein N. had a "fabulous" power of detecting faint lights and colors, but even for her the sensitiveness to light outside of the fovea was two or three times greater than at it. But, for the detection of color, the general shape of the curve is reversed. All colors (if the eye has undergone adaptation by the observer's remaining for fifteen minutes in a dark room) are best perceived at the fovea. Red light has the peculiarity to be seen to be light and to be red at very nearly the same instant, at the fovea. For all other colors much less illumination is necessary to see them than to name them, even at the fovea, and beyond it the difference increases rapidly.

Charpentier stated that the color of a group of points can be named sooner than they can be counted, and exactly four times sooner for all colors. Fick found that so simple a rule is far from holding; a small number of yellow points, for instance, were counted with six times less illumination than was necessary for distinguishing their color. C. L. F.

Ueber das Verhalten der normalen Adaptation. TREITEL. Graefe's Arch. f. Ophth. XXXIII, 2, p. 73.

Aubert found that the sensitiveness of the eye was increased 35-fold by remaining for two hours in a darkened room. Landolt found that with increasing adaptation, the order in which the colors were recognized was green, yellow, red, blue, violet. Treitel, by first blinding the eyes, obtained a difference of visual power of 120-fold. After fatiguing by different colors, the order of recovery for the different colors was as follows:

After Red-fatigue	G, B, Y, R.
" Blue "	Y, R, G, B.
" Green "	R, B, Y, G.
" Yellow "	R, B, G, Y.

The fatigue must take place in the retina, for it proceeds in the two eyes independently of each other. The fovea is much slower in recovering than the lateral portions of the eye. The coincidence between the time which is required for adaptation to take place and for the visual purple (or rod-purple, as it ought to be called) to become restored, points to a connection between the two processes. This is confirmed by the fact that symptomatic night-blindness occurs with diseases of the eye which attack the pigment-epithelium. Idiopathic night-blindness is always a result of excessive exposure to light; in a poor state of nutrition, among old people, for instance, a slight exposure is sufficient to bring it on.

Die Analyse der Lichtwellen durch das Auge. A. GÖLLER. Du Bois-Reymond's Archiv, 1888, I and II, p. 139.

If natural white light is first polarized, then passed through a thin piece of quartz, and then examined by an analysing prism, it will be found that the quartz has had the effect of rotating the plane of polarization, but by a different amount for the different colors. If

the piece of quartz is very thin, the whole spectrum is run through by a rotation of the analyser of less than 180°. This is rotatory polarization, and it is by rotatory polarization that Göller explains the analysis by the eye of ether vibrations into sensations of differently colored lights. Monochromatic light, on entering the eye, passes through the transparent retina, and is reflected back from the pigment-epithelium in a state of plane polarization. The outer members of the cones play the part of the piece of quartz—they shift the plane of polarization by a definite angle. A molecular motion, of much slower period, is then set up in the protoplasm of the inner members, and it is the sensitiveness of the nervous filament to the plane of this motion which constitutes the sensation of color. Two complementary colors are colors which have had their planes of polarization rotated one ninety degrees more than the other, at the same time that the phase of one has become a quarter wave-length behind that of the other, the amplitudes being the same. These conditions, Göller says, would be sufficient to cause their superimposed harmonic motions to produce the motion of circular polarization, and that would be indistinguishable from the motion produced by all the colors of white light acting together. Two vibrations whose planes were at a different angle, would give an elliptic motion of such a kind that the direction of its major axis would give its tint, the excess of the major axis over the minor would give its saturation, and the minor axis would give the amount of white light mixed with it. No two colors other than those described above could give white light, for motion in a circle can only be produced, Göller says, by two rectilinear motions of the same amplitude and at right angles to each other, and thus is explained the fact that most colors when mixed in no matter what proportion cannot be made to produce white light. This exposition seems to contain two grave errors, both depending upon the fact that Göller has apparently overlooked the effect of the period upon the composition of harmonic motions. Two harmonic motions at right angles to each other cannot produce circular motion unless their period is the same; and to suppose that the outer members of the cones, besides the difficult functions already assigned to them, had also the power of equalizing the periods of all rays transmitted by them, would be much too forcible an assumption. Again, it is not true that two simple harmonic motions which are not at right angles to each other cannot produce motion in a circle, if the right difference of phase is chosen to fit their inclination, any more than it is true that the square is the only parallelogram in which a circle can be enclosed. This theory, therefore, which looks rather interesting at first sight, would seem to be utterly untenable. It is possible that some polarization theory might be proposed, with a somewhat different set of assumptions, which would stand examination; the chemical theory is far from being so well established as it is commonly assumed to be. The assumption that there are colorless visual substances, which act after the rod-purple is bleached, and in those places where it never existed, is a purely gratuitous one, and not the slightest reason has been brought forward to support it. C. L. F.